existing knowledge of the prevailing weather conditions in that square. It therefore happens that there are many squares whose meteorological conditions are very well known, on account of the very great number of vessels which traverse them; while, on the contrary, there are other squares which lie off the tracks of commerce whose meteorological conditions are only approximately known. In addition to this graphic representation of the frequency and force of prevailing winds in each ocean square, there is printed a brief forecast and a table showing the normal reading of the barometer, arranged in tabular form by ocean squares. A double dotted line near Newfoundland shows the probable limit of the region of frequent fogs for the coming month, and dotted lines across the lower parts of the chart indicate the limits of the trade-winds. Where the north-east and south-east trade-winds meet, there is the region of equatorial rains, indicated on the chart by a blue belt of irregular shape, lying principally north of the equator. These constitute the blue data or portions of the chart.

The portions of the chart printed in red comprise information collected during the month preceding the date of issue. On the ocean are plotted the latest reported positions of derelict vessels, wrecks and drifting buoys. Dotted lines indicate the drift which each wreck has followed since it was first reported. There are also plotted the positions where whales and waterspouts were reported during the previous month, and a red belt off Newfoundland indicates the region where frequent fogs were encountered. In the lower right-hand corner is printed a brief weather review of the preceding month, written at the last moment before going to press, but necessarily more or less incomplete so far as the entire Atlantic is concerned. Above is a large amount of printed matter, comprising a list of notices to mariners issued during the previous month, dangerous obstructions to navigation along the coast, charts published and cancelled, transatlantic steamship and sailing routes, the latest reported positions of logs from the big lumber raft which was abandoned off Nantucket, and various other matter likely to be of timely interest. To one who is not familiar with the subject it would seem almost impossible to publish on one chart such a variety of information of such a diverse character, and yet have a chart that can be of practical use in plotting a vessel's track. It would be very difficult to do without the distinction of colors.

In describing the methods by which the data for the Pilot Chart are collected from masters of vessels, Mr. Hayden referred to the branch hydrographic offices established in Boston, New York, Philadelphia, Baltimore, New Orleans, and San Francisco. At these offices masters of vessels can find all the latest nautical information — charts, light-lists, sailing directions — for every ocean of the globe, and standard barometers and thermometers for purposes of comparison. The naval officer in charge of such a branch office, during his three-years' tour of shore duty, is thrown into intimate relations with the owners, agents, and especially with the practical and energetic masters, of merchant vessels of every description, to mutual advantage, and to the benefit of both the commercial marine and the naval service. Mr. Hayden referred for illustration to the working of the branch office established in the Maritime Exchange, New York, which Lieut. V. L. Cottman, U.S.N., during the few years he has been in charge, has brought into a position of usefulness commensurate with the vast shipping interests of the great commercial metropolis of the United States. In a single year (1886–87), 6,739 vessels were visited, nautical information furnished to 83,345 masters of vessels and others, 10,397 Pilot Charts distributed, and 3,601 special detailed reports of marine meteorology forwarded for use in the preparation of the Pilot Chart alone, in addition to all the regular office-work, of which this is but a small fraction.

ELECTRICAL SCIENCE.

Change of Potential in a Voltaic Couple by Variation of Strength of the Liquid.

DR. G. GORE, F.R.S., read before the Royal Society, June 14, a communication on the above subject. A voltaic couple, consisting of zinc and platinum in distilled water, was opposed to a thermo-electric pile, the latter being regulated until there was no deflection of a galvanometer in the circuit. To the distilled water there was added potassic chlorate, potassic chloride, hydrochloric acid, or bromine, in gradually increasing quantities, and the change in the electro-motive force of the voltaic couple was measured in each case. The following are the minimum proportions of the above substances required to change the potential of the couple in water: potassic chlorate, between 1 in 221 and 1 in 258 parts of water; potassic chloride, between 1 in 695,067 and 1,390,134; hydrochloric acid, between 1 in 9,300,000 and 9,388,188; of bromine, between 1 in 77,500,000 and 84,545,000 parts. With each of these substances a gradual and uniform increase of the strength of the solution from the weakest to a saturated solution was attended by a more or less irregular change of electro-motive force.

By plotting the results in curves, — the quantities of dissolved substance as ordinates, the electro-motive forces as abscissæ, — each substance will yield a different curve, the form of which is characteristic of the substance.

As a very slight addition of a foreign substance greatly changes the 'minimum point,' and alters the curve of variation of potential, the two may probably be used as tests of the chemical composition of the substance, and as a means of examining its state of combination when dissolved.

THE 'MINIMUM POINT' OF CHANGE OF POTENTIAL OF A VOLTAIC COUPLE. — Dr. Gore, at the same meeting of the Royal Society, described experiments made to determine the minimum amount of any substance that would affect the electro-motive force of a voltaic cell. To do this he arranged two magnesium-platinum couples in distilled water, and opposed them to each other with a sensitive galvanometer in their circuit. He then added known quantities of the substances to be investigated to one of the cells, and noted when the balance between the two couples was upset. The results were as follows: potassic chloride, between 1 part in 3,875 and 4,650 parts of water; potassic chlorate, between 1 in 4,650 and 5,166; hydrochloric acid, between 1 in 516,666 and 664,285; chlorine, between 1 in 15,656,500,000 and 19,565,210,000. The proportion required of each of these different substances is dependent upon very simple conditions, — unchanged composition of the voltaic couple, uniform temperature, and the employment of the same galvanometer. If a more sensitive galvanometer was employed, of course the numbers would be increased, but they are relatively correct. With constant conditions, the numbers obtained may possibly be used to test the purity or the uniformity of composition of the dissolved substances. The 'minimum point' varies with (1) the chemical composition of the liquid; (2) the kind of positive metal; (3) to a less degree with the kind of negative metal; (4) the temperature at the surface of the positive metal, and that of the negative one; (5) with the galvanometer used. The degree of sensitiveness is related to the degree of free chemical energy of the liquid, also to the atomic and molecular weights of the dissolved substances. The greater the degree of the free chemical energy of the dissolved substance, and the greater its action upon the positive metal, the smaller the proportion of it required to change the potential. As the 'minimum point' of a substance dissolved in water is usually much altered by adding almost any soluble substance to the mixture, measurements of that point in a number of liquids at a given temperature, with the same voltaic pair and galvanometer, will probably throw some light upon the degree of chemical freedom of substances dissolved in water.

ELECTRICAL TREATMENT OF ZINC AND ITS ORES. — Mr. Alexander Watt has brought forward a process of purifying and reducing zinc that promises to be largely used. In the purifying process the zinc is made the anode in a bath containing an organic acid, and is dissolved and deposited upon the cathode. Acetic acid is generally used in the process, the ordinary commercial acid being mixed with water in the proportion of one to two. The impure zinc plates are suspended in the bath, and the pure zinc is deposited on thin zinc plates, or on copper or iron plates coated with plumbago. When the operation is finished, the cathode plates are washed, and melted into ingots. To reduce the ores of zinc, especially the carbonate, the minerals are first reduced to a powder, and then submitted to the action of the acid, being added a little at a time. When the zinc is completely dissolved, the liquid is allowed to stand, and is then drawn off, and mixed with water in equal pro-

portions. In electrolyzing this liquid the anode plates are carbon, platinum, or some other substance not acted on by the acid: the cathode plates are zinc, carbon, etc. To keep the saturation constant, and to prevent polarization from an excess of free acid, Mr. Watt has devised a system of circulation by which the used-up liquid is restored to its original density in special reservoirs, and is used over and over again. In the treatment of blende or native sulphate of zinc, the ores are first roasted, after which they are pulverized and put in acid, as has been described. The process is said to be more economical than those now in use, but it has not been tested by experiment on a large scale.

ELECTRIC TESTING BUREAU AT JOHNS HOPKINS UNIVERSITY. — In a circular that has just been issued by the Johns Hopkins University is the announcement that an electric testing bureau is to be opened from Sept. 1. The circular, besides the announcement, gives the general methods of measurement that are to be employed. Such a bureau has been needed for some years. With the rapid increase in the number and importance of the applications of electricity in this country, the necessity of more accurate methods of measurement has become more and more apparent. In order that such measurements shall be uniform and comparable, they must be in terms of the same standards, and these standards should be referred to the system of absolute units, whose adoption has been of such benefit to physical science. The instruments in use for commercial measurements have constants that are liable to change in time; and electrical resistances, especially those used in accurate researches, should be carefully compared with standards. But besides the comparison of instruments and resistances, tests of batteries, dynamos, motors, etc., are to be made. This is an especially valuable feature, for almost every day brings the invention of some new storage or primary battery, dynamo, or motor, and it is not often that the inventor is in position to accurately test the value of his invention. For those who wish to develop any new discovery, it would be well to have some place of reference, where its value and possibilities can be impartially determined. The establishment of similar bureaus in France, Germany, Austria, and England has called attention to the necessity of something of the kind here. The applications of electricity in this country are much more important and extended than in any other, and it is to be hoped that this new departure will aid in their development. The Johns Hopkins University seems especially fitted to undertake the work; for, besides the excellent equipment of the laboratories, the institution has been more or less identified with accurate measurements since the classical determination of the mechanical equivalent of heat, made in 1878 by Professor Rowland. More lately important experiments have been made on the determination of the ohm, and the specific resistance of mercury. The list of prices given in the circular is reasonable, and the bureau should be well patronized.

HEALTH MATTERS.

Malaria.

THE subject of malaria and its causation was thoroughly discussed at the last meeting of the American Medical Association. One of the contributions was from the pen of Dr. Henry B. Baker. His conclusions were as follows: 1. Intermittent fever is proportional, directly or inversely, to the average daily range of atmospheric temperature. 2. The controlling cause of intermittent fever is exposure to insidious changes in the atmospheric temperature. 3. In the mechanism of the causation of intermittent fever the chief factor is the delay in the re-action to exposure to cool air: this delay, extending to a time when greater heat loss should occur, results in the abnormal accumulation of heat in the interior of the body and in disturbed nervous action, — the chill; and the final re-action is excessive, because of the accumulation of heat, and sometimes because it occurs at the warmest part of the day. 4. The fever is the excessive re-action from the insidious influence of the exposure to cool air; and it is periodical because of the periodicity of nervous action, and because the exposure and the consequent chill are periodical, owing to the absence of the warmth from the sun at night. 5. Residence in valleys or on lowlands through which or upon which cold air flows at night, and thus causes insidious changes in the atmospheric temperature, favors intermittent fever. 6. In our climate those measures, such as drainage, which enable the soil to retain warmth during the night, and thus reduce the daily range of temperature immediately over such soil, tend to decrease intermittent fever among residents thereon. 7. In the cure and prophylaxis of intermittent fever, those remedies are useful which lessen torpidity (especially of the liver) and tend to increase the power of the body to re-act promptly to insidious changes in atmospheric temperature.

A paper entitled 'Malaria and the Causation of Fever in the State of New York' was presented by Dr. A. N. Bell of Brooklyn. As a result of his observation and study, he concludes that malaria is coincident with accumulations of organic matter in process of putrefaction in alluvial bottoms, on the margins of sluggish streams, low humid borders of stagnant ponds and lakes, the marshy borders of the seashore, and circumscribed local conditions, chiefly artificial, comprehending more or less the same relations to vegetable *débris* and other organic matter in process of decay as the outlying conditions mentioned in this connection. While it is not possible in the present state of our knowledge to determine the special relations existing between malarial diseases and the geological, thermal, hygrometrical, and barometrical conditions under which they occur, those thermal and hygrometrical conditions most promotive of putrefaction coincident with the absence of sunlight are in the highest degree promotive of malarial poison.

Prof. Tommasi Crudeli sent a letter to the association, expressing the opinion that it was impossible for a person to have ague without the presence in his body of the *bacillus malariæ*. Dr. Bernardo Schiavuzzi of Pola, in a written communication, expressed himself a believer in this bacillus, and supported his belief by a statement of experiments on rabbits. Professor Laveran sent a paper on the *hematozoon malariæ*.

CANCER. — The fatal result which almost inevitably attends cancer has caused investigators to search with unremitting zeal for a specific. This search is now prosecuted with more hopefulness than ever, by reason of the belief in many minds that cancer is a specific disease depending on a germ for its causation. One of the remedies from which much was expected was Chian turpentine. Although this has had its advocates in the past, it has never sustained a very high place in the profession generally. Recently it has again come into favor, principally through the reported cures occurring in the practice of Professor John Clay, obstetric surgeon to the Queen's Hospital, Birmingham, England. In these reports are included cases of cancer of the uterus, rectum, and skin. At the same time a trial of the remedy at the London Cancer Hospital has been made, with conflicting results. Dr. Daniel Lewis, surgeon to the New York Skin and Cancer Hospital, reports hopefully of the remedy, but in a communication to the New York *Medical Journal* says that he has been using it in too limited a number of cases to decide as to its curative properties. Chian turpentine is the product of a tree, the *Pistacia terebinthus*, which grows on the island of Scio in the Mediterranean. The turpentine, as it comes to this country, is a soft solid, becoming brittle when exposed to the air. It has an agreeable odor, somewhat like that of turpentine, and very little taste. The remedy is given in the form of an emulsion with mucilage of acacia, a solution of the turpentine having first been made with sulphuric ether.

TYPHOID FEVER. — The Paris correspondent of the New York *Medical Journal* reports that Professor Proust, who holds the chair of hygiene at the faculty of medicine there, has been giving a series of lectures on epidemics of typhoid fever and other diseases provoked by the ingestion of meat from diseased animals. One of the most important questions raised is that of whether it has been established that typhoid fever is a specific malady, caused by a certain organism called Eberth's bacillus. In Paris this doctrine has for the most part been accepted since the late studies made by Professor Brouardel and Dr. Chantemesse, who showed that this bacillus could be traced to the water-supply. It will be remembered, however, that Murchison held that the typhoid contagium could be developed in any putrid matter, and by this theory it is